

STUDY OF INTER-COUNTRIES FREIGHT TRANSPORT USING ACTIVITY-BASED METHOD (CASE STUDY: WEST KALIMANTAN, INDONESIA – SARAWAK, MALAYSIA)

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ABSTRACT

The freight sector moves vast volumes of goods, commodities, materials, and food, domestically and globally, and is a primary factor in economic growth and development. It is not possible to capture the strategic decisions that individual firms make regarding their supply chain design and operations using a four-step model. In the modelling of freight transport, activity-based approaches predict location, time, duration, mode and route of transportation, and similar characteristics of activities. The methodology of this research started with problems identification of inter-countries freight transport, namely Indonesia (West Kalimantan) and Malaysia (Sarawak). The problems encountered are inefficiency and ineffectiveness in freight transportation namely time parameter and transportation costs. The secondary data was obtained from the Central Bureau of Statistics of West Kalimantan Province while the primary data comprises of (i) vehicle types of freight transportation, vehicle capacity of freight transportation, volume of export commodities; (ii) travel time of goods vehicle; (iii) cost of freight transportation, especially that of fuel cost; (iv) time schedule of departure and arrival of vehicles, and (v) the choice of route. Two samples of starting point are Pontianak and Sambas. The distance between Pontianak – Entikong and Sambas – Entikong are respectively 248.0 km and 346.0 km; thus the travel time for the two routes are more or less 12 and 14 hours. Based on the results of questionnaires, it is learned that the schedule is twice a week. The resultant analysis using activity-based method, West Kalimantan province has a very limited road-network, and consequently, therefore there are no alternatives that could be made by the drivers to minimize operational costs, there are no consolidation of goods for similar type of vehicles and or similar capacity, of which could be seen from the variation of goods volume of the above mentioned vehicles. The route from Sambas to Entikong could have been made more efficient if there had been relatively straight road.

Keywords: Activity-based; Freight transport; Inefficient; Inter-countries

1. INTRODUCTION

Freight transportation is a vital element in the economic prosperity of any country and directly affects the productivity rate in many aspects. The freight sector moves vast volumes of goods, commodities, materials, and food, domestically and globally, and is a primary factor in economic growth and development. But goods movement comes with an impact on the planet's environment: it contributes a significant portion of mobile source air pollution emissions, and its contribution is expected to grow significantly in coming years. The volume of freight flows within many countries has almost doubled the rate of population increase over the past three decades

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(Transportation Research Board, 2008). As the businesses increasingly adopt sophisticated supply chain management strategies, the freight shipment decision-making process is becoming even more complicated. Population increase, economic growth, proliferation of e-commerce, and greater dependence on transportation in the production process, on the other hand, are driving freight movements to reach unprecedented levels (Southworth, 2003).

Major research efforts in travel demand modeling have mainly concentrated on the passenger transportation in the past. As a result, the state-of-the-art in behavioral freight modeling lags far behind that for passenger transportation (Pendyala et al., 2000). It is not possible to capture the strategic decisions that individual firms make regarding their supply chain design and operations using a four-step model. The conventional four-step approach is the state-of-the practice in the modeling of freight transport (Cambridge Systematics, Inc. et al., 2008), primarily because of the simplicity of aggregate models to be developed based upon non-intensive data (Pendyala et al., 2000). Hereupon, researchers have tried to address the previously mentioned gaps in the freight transportation modeling literature. In a general classification, applied models in the statewide freight transportation can be categorized as (1) vehicle-based, (2) commodity based, (3) agent-based, and (4) integrated models.

This is a great need for better forecast models of freight transport. Some attempts to improve model results have already been made and freight modelling is moving to more activity-based models. A limited number of studies have tried to apply the activity-based approach to freight transportation modeling, but due to the lack of data, most have not produced satisfactory results (Hensher and Figliozzi, 2007). A substantial proportion of current and future regional freight movements will concentrate on a relatively small number of strategic corridors and facilities.

Generally, the problems can be identified by measuring the performance of freight transport (Hagler Bailly Services, 2000), which consist of (i) Cost of highway freight per ton-mile; (ii) Hours of delay at border crossing; (iii) Travel time in freight significant corridor; (iv) Expenses per mile for the Motor Carrier Industry; (v) Improvements in the Movement of Highway and Intermodal Freight.

Activity-based models share some similarities to traditional 4-step models: activities are generated, destinations for the activities are identified, travel modes are determined, and the specific network facilities or routes used for each trip are predicted. However, activity-based models incorporate some significant advances over 4-step trip-based models, such as the explicit representation of realistic constraints of time and space and the linkages among activities and travel. In the modelling of freight transport, activity-based approaches predict location, time, duration, mode and route of transportation, and similar characteristics of activities for the purpose of a better prediction.

2. METHODOLOGY

The methodology of this research started with problems identification of inter-countries freight transportation, namely Indonesia (West Kalimantan) and Malaysia (Sarawak). The underlying problem that exists on freight transportation between Indonesia (West Kalimantan Province) and Malaysia (Sarawak State) includes technical aspects and regulations. The regulatory aspects could be identified by the banning of import for some of the goods and the obligation of freight vehicle transportation to stop at the Malaysian inland port (Tebedu Inland Port) and then replaced by the Malaysian goods vehicle transportation. The technical aspect is related with the mechanism of goods

transportation. Exports of Indonesian goods undergoing inefficiency be it from the ways of transportation and export mechanism in order to arrive at the transportation node at the neighboring country. The existing condition shows the necessity for travel demand and transportation mechanism to the neighboring country. The collected data comprises of primary and secondary data. The secondary data is obtained from Central Bureau of Statistics of West Kalimantan Province in the form of Foreign Trade Statistical Data of West Kalimantan in 2014 and the export development data of West Kalimantan Province as per the December 2015. The primary data consists of : (i) travel time of freight vehicles; (ii) transportation cost particularly that of fuel; (iii) the number of hours cruised from the start until arrival at the border; (iv) selection of route. West Kalimantan Province is one of the provinces that directly borders with the neighboring country, Malaysia. The border areas in Kalimantan constitute as one of National Strategic Areas situated along the border between Indonesia and Malaysia. West Kalimantan Province, in particular, stretches an area of more or less 966 kilometers that include 40 villages, 15 districts, 5 regencies with a total of 20,352 sq, kilometers. Of the border areas, the one with a highest economic growth and traffic movement is the border crossing check-point at Entikong district of Sanggau regency.

3. RESULTS

3.1 Export from West Kalimantan Based on Main-Exporting Countries

Generally, the increase of export volume of West Kalimantan Province in the last decade is highly fluctuated. The highest export volume was reached in 2013 at 16.775.583,12 tons, while in 2011 it reached 15.732.397,34 tons but it decreased 2014 with an export volume of 1.171.286,89 tons.

Japan, Mainland China and South Korea have become the West Kalimantan Province's main importing countries 2014, where respective export values to each country are US \$169,58 millions, US \$155,66 millions and US \$135,83 millions. Meanwhile, the export value to Malaysia occupies 4th in rank amounting to US \$54,17 or equivalent to 8,31% of the total export. [It is worth noted that export value is expressed in FOB term where the transactional price between the exporter and the overseas buyer taking place at the exporter's port while import value is expressed in CIF term where transactional price between the overseas seller and the importer taking place at the importer's port].

3.2 Import Rate of West Kalimantan

The total volume and value of West Kalimantan Province's import in the last decade is highly fluctuated where the highest import totaling to US \$500.26 million in 2014 and the lowest in 2005 at a total of US \$60.29 million

3.2.1. Border Crossing Check point of Entikong

3.2.1.1 Export Through Entikong

Entikong is one of border crossing check-point of Sanggau regency which is equipped with Custom, Immigration, Quarantine and Security (CIQS). The amount of export items (based on goods code as Harmonized System/HS) is 51 items, with total net weight and FOB rate, respectively are 39,476 tons and US \$31.4 millions.

Tabel 1 Seven Main Commodities Exported To Malaysia (based on net weight) Through Entikong in 2014

No	Commodities	Net weight [kg]
1	Fat, animal and vegetable oil constitutes	36,531,440
2	Food processed from flour	1,065,922
3	Waste/ recycle of food industry	449,668
4	Various processed food	323,994
5	Soap and cleaner smear	294,917
6	Baverage	182,618
7	Atsiri oil, cosmetics and perfumes	160,232

From table 1, it is learned that the most dominant commodity is fat, animal and vegetable oil constitutes 92,54% of total export from Entikong to Malaysia in term of net weight. The second dominant commodity in term of its volume is food processed from flour totaling only 1.065.922 far below the main commodity. The third dominant commodity only weighed below 500.000 kg while fish and shrimps being strategic commodity with an export of only as many as 2.526 tons with a value of US \$8.903. With as many as 51 items, it is learned that there are extremely many commodities exported in very small quantity.

The percentage of export to Malaysia through and non through Entikong in the year 2014 could be seen from the following picture.

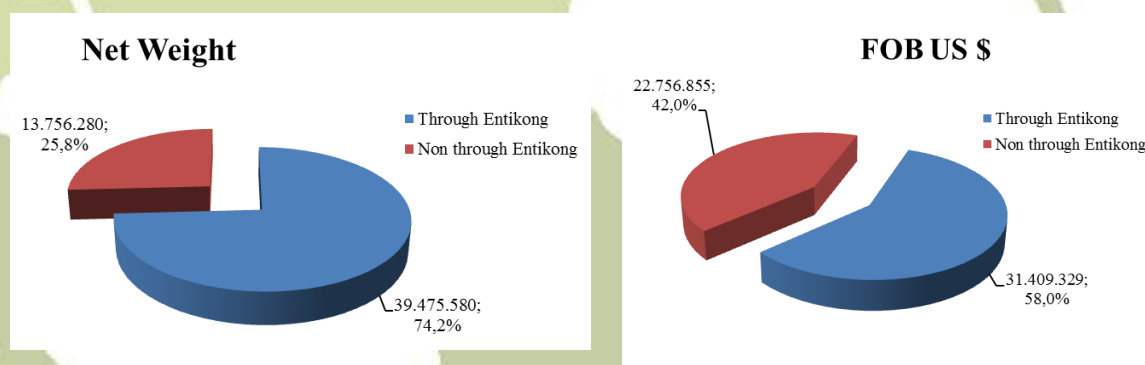


Figure 1 The percentage of export to Malaysia Through and Non Through Entikong in 2014

3.2.1.2. Import Through Entikong

The data on imported commodities through Entikong, its net weight and values in 2014 could be seen from the following table.

Table 2 Import of West Kalimantan based on Load Port and Commodities in 2014

No	Load Port	HS2	Commodities	Net Weight [kg]	CIF Value [US \$]
7	Entikong	25	Salt, Sulphur, Lime	1,427,500	171,003
		84	Engines/Mechanical instrument	794,510	3,157,947
				2,222,010	3,328,950

Tabel 2 shows that the import through Entikong is still very low in quantity that is below 5,63 % in net weight and only 10% when compared to export value.

3.2.2 Freight Travel Data

1. Commodities

Data commodity and characteristics of freight vehicles obtained from the respondent residing in Pontianak and Sambas cities could be seen from the following table.

Table 3 Commodities and Characteristic of the Freight Vehicles

No.	Origin	Commodities		Type of Freight Vehicle	Veh Capacity [tonnage]
		Type	Net weight [tons]		
1	Pontianak	Fish, shrimp	2.0 – 3.15	Truck, Truck+box	7
		Bread	5.0 – 6.0	Truck, Truck+box	7
		Staple	10.0 – 11.0	Truck	12
2	Sambas	Fish, crab	1.5 – 2.75	Truck	7

West Kalimantan Province has a very limited road network. The route taken by freight vehicles both from Pontianak Entikong and Sambas Entikong could be seen from the following table.

Table 4 The Route of Freight Vehicle

No.	Origin	The Route of Freight Vehicle
1	Pontianak	Pontianak City –Trans Kalimantan highway –Tayan highway (Sosok) –Sosok II highway –Lintas Malindo highway – Entikong City
2	Sambas	Sambas City –Sanggau Ledo highway –Bengkayang highway (Ngabang) – Pahauman highway (Ngabang) –Ngabang highway –Sosok highway –Lintas Malindo highway – Entikong City

The route of freight vehicle mention above can be seen at maps below.

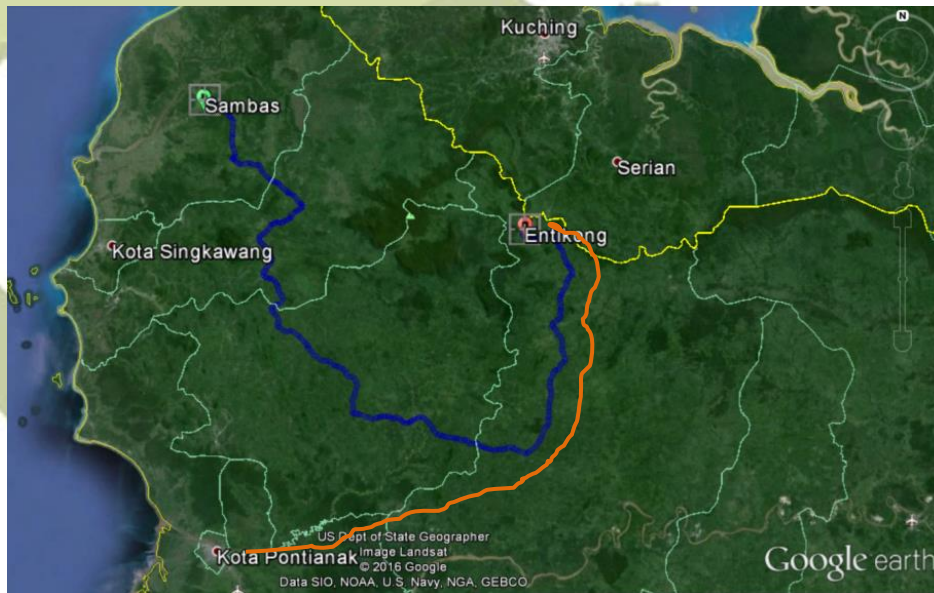


Figure 2 Route of Freight Vehicle From Pontianak and Sambas to Entikong (Based on Google Earth map)

Table 5 Freight Schedule and Average Travel Time

No.	Travel Origin-Destination	Schedule		Average Travel Time	Distance
		Departure	Arrive	[hours]	[kms]
1	Pontianak – Entikong	19.00 – 21.00	07.00 – 08.00	12.0	248.0
2	Sambas - Entikong	19.00 – 20.00	09.00 – 10.00	14.0	346.0

From the results of secondary data duly collected and conducted interviews, it is learned that the travels are started in the evening and through the night in order to reach the border at morning hours. The average travel time for both routes is 12 hours for Pontianak Entikong and 14 hours for Sambas Entikong respectively. The difference of the travel time is due to the fact that Sambas Entikong is farther than Pontianak Entikong.

Table 6 Fuel Costs of Freight Vehicle (round way)

No.	Origin	of Freight Veh.		Cost of Fuel
		Type	Capacity [tonnage]	[Rp]
1	Pontianak	Truck	7	650,000 – 700,000
		Truck+box	7	650,000 – 700,000
		Truck	12	1,000,000 – 1,100,000
2	Sambas	Truck	7	900,000 – 950,000

Freight transportation is carried out by way of trucks and boxed trucks that vary in tonnage, namely 7 and 12 tons. The Sambas Entikong route is served by the 7 tonnage trucks while the fuel cost varies between the 7 and 12 tonnage trucks, as well as that of route where Sambas Entikong route is farther.

4. DISCUSSION

From the data displayed above, the opportunity of West Kalimantan Province to increase its export volume and values is unquestionably great. By comparing the tonnage and export value through Entikong against the total export to Malaysia amounting respectively 74.2% and 58.0% there is still a big opportunity to increase or to enhance its export value.

Observation has been made on export flow of goods to the neighboring country, Malaysia, Sarawak State), with a variety of commodities such as fish, crabs, shrimps, bread and staple foods coming from two cities namely Pontianak and Sambas. Freight vehicles used to transport such are trucks and boxed trucks with a capacity respectively 7 and 12 tons. The load depends on the type of commodity where averagely the lightest are fish, shrimps and crabs weighing 1.5 to 3.15 tons while bread and staple foods respectively weighing 5,0 to 6.0 tons and 10 to 11 tons.

The freight vehicles run on routes of national status roads. Although some of the roads in West Kalimantan have that status, most of them are not as yet adequate both in terms of capacity and quality. Identification of problems on nationally classified roads used as inter-countries freight transportation is ranging from the use of inadequate roads as well as arterial roads in quite a lot of instances for local transportation.

The West Kalimantan Province has a very limited road network (low quality and road capacity) that such a condition makes the drivers of freight vehicles have no alternatives to be considered in order to minimize operational costs.

The length of routes from Pontianak Entikong and Sambas Entikong are respectively 248.0 kilometres and 346.0 kilometres with an average travel time of 12.0 and 14.0 hours. The imposition of limitation on or the banning of freight vehicles to move across city areas during daytime has forced the drivers to leave early in the evening for the purpose of arriving at the border the following morning. Based on the resultant interviews, it is learned that the schedule for transporting the commodities from each city of origin is made twice a week.

The condition is as such that, in Malaysia, the already existing and operating inland port has thus affected the characteristics or the inter-state freight transportation. After all documents and commodities from Indonesia been inspected at the balai karantina, all freight vehicles coming from Indonesia should end their journeys at Tebedu inland port and the goods are then re-loaded on to Malaysian freight vehicles for further travel inside the Malaysian territory.

5. CONCLUSION

From the resultant analysis, it is learned that there has been no consolidation in term of load of the same type of commodity. This could be observed from the variety of loads from one vehicle to another. Load consolidation is one way of efficiency so as to reduce the number of vehicles used by loading them up to the limit of their payload. In addition to the above, there are different characteristics such as the capacity of freight vehicle and type of vehicle used to adapt to the type of commodities to transport where some commodities require a closed vehicle such as boxed truck in order to minimize the impact of weather condition. By analyzing the route of freight transport vehicles both from Pontianak to Entikong and Sambas to Entikong, it learned that Pontianak Entikong route is relatively straight whereby the Sambas Entikong route is a detour one. The Sambas Entikong route could be made more efficiently by constructing a much straight road.

By analyzing the conditions previously described, for the purpose of providing recommendation and the necessity for improving the freight transport system especially between countries, it reveals that the four-step model has failed to contribute good results because it only collects aggregated inter-zone data. Meanwhile, activity-based method can provide recommendation for the decision makers as it produces a more detailed analysis and captures the required parameters of freight transport namely type of commodity, volume of transported commodity, selection of route for goods transportation, capacity of freight transport vehicles, and schedule of freight transport.

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